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Natural products and altered derivatives as tracers for biomass combustion in aerosols

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Biomass combustion is an important primary source of carbonaceous particles in the global atmosphere. Various molecular markers have been proposed for this process but additional specific tracers are needed. The injection of natural product organic compounds into smoke occurs primarily by direct volatilization/steam stripping and by pyrolysis. Although the composition of organic matter in smoke particles is highly variable, the molecular structures of the tracers are generally source specific. Homologous compounds and biomarkers present in smoke are derived directly from plant wax, gum and resin by volatilization and secondarily from pyrolysis of biopolymers (e.g., lignin, cutin, suhrin), wax, gum and resin. The component complexity is illustrated with examples from controlled burns of temperate and tropical biomass fuels. Conifer smoke contains characteristic tracers from diterpenoids as well as phenolics and other oxygenated species. These are recognizable in urban airsheds. The major organic components of smoke from tropical biomass are straight-chain, aliphatic and oxygenated compounds and triterpenoids. Several compounds are potential key indicators for combustion of such biomass. The precursor to product approach of organic geochemistry can be applied successfully to provide molecular tracers for studying smoke plume chemistry and dispersion.